AGEING AND PERSONAL RETIREMENT SAVINGS PLAN PARTICIPATION WITH HETEROGENEITY IN PREFERENCES: THE PORTUGUESE CASE

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Abstract

This paper analyses the relationship between ageing and personal retirement savings plan participation in the Portuguese population, taking into account heterogeneity and endogeneity in preferences. A mixed logit model is used to analyse the determinants of retirement saving behaviour, allowing for heterogeneity and endogeneity in the responses. We find considerable heterogeneity among individuals (in terms of socio-economic variables such as age, gender and income), which must be taken into account by any policy aimed at changing retirement saving behaviour.

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1. Introduction

This paper adopts an innovative approach to analyse the determinants of participation in personal retirement savings plans, based on a questionnaire distributed among the Portuguese population in 2004. We analyse the data with a mixed logit model, which allows for heterogeneity and endogeneity in the variables. This type of model has been previously utilised in various fields of research such as terrorism (Barros and Proença, 2005), agriculture (Alfnes, 2004), transportation (Bath, 1996; Brownstone and Train, 1999; Brownstone et al., 2000), recreation, (Train, 1998), energy (Revelt and Train, 1998) and marketing (Bonnet and Simioni, 2001). However, in the literature on retirement saving logit and probit models are seldom used to analyse data from questionnaires (Barsky et al., 1998; Papke, 1995; Papke and Poterba, 1995, and Engelhardt, and Kumar, 2004). Therefore, the present paper innovates in this field.

The motivation for the present study is the impact of pension reforms on private wealth accumulation. Demographic and economic factors are affecting the financial sustainability of Social Security systems everywhere in the developed world. This is a hotly debated issue in the European Union (European Commission, 2003; OECD, 2001, 2003), including Portugal (Silva et al., 2004), and elsewhere (World Bank, 1994, 2001). Some of the recent reforms include increasing the retirement age, using new methods to calculate pensions (reducing the replacement rate), and the creation of reserve funds. The role of private occupational pension plans and personal savings plans is also becoming more important.

Individual behaviour with respect to retirement saving is highly dependent on the default options of personal pension plans as well as on various socio-economic and

psychological characteristics. The availability of individual retirement age and replacement rate expectations affects significantly the impact of pension reforms on private wealth. To boost retirement saving, it is necessary to understand individuals' saving behaviour, which is the aim of our research. We analyse the responses to the survey conducted in Portugal in 2004 with the aim of establishing the determinants of the decision to subscribe to a personal retirement savings plan. The questions were designed to capture respondents' perceptions, attitudes and behaviour in relation to longevity, the retirement period, saving and the replacement rate, respectively.

The paper is organised as follows: Section 2 describes the institutional framework; Section 3 reviews the existing literature; Section 4 outlines the model and presents the data; Section 5 presents the empirical results; Section 6 offers some concluding remarks.

2. Institutional framework

The relationship between the retired and active populations crucially depends on the demographic structure: fewer young people today imply fewer workers in the future, while greater longevity implies a greater number of old-age pensioners, in relative terms. The proportion of the young in Portugal has been declining dramatically (by 44.64% over the period 1960-2001), dropping to 40.8% by 2001 (Demographics Statistics 2002, European Commission). Moreover, the projected figure of 41.9% for 2020 gives no cause for optimism. Over the period 1960-2020 the decline has been of the order of 43.15%. On the other hand, the proportion of Portuguese aged 60 or more increased by roughly 76.5% between 1960 and 2001, and it is estimated that the dependency ratio will be 45% by 2020, a scenario which is slightly less worrying than the one implied by projections

for the EU-15 as a whole. The two main factors responsible for these developments have been the fertility rate and life expectancy.

The implications for the financial sustainability and functioning of the Social Security system are significant. The crucial question concerns the best course of action to keep the contribution rate constant. In many countries, raising the standard age of retirement is being suggested in order to minimise the effects of increased longevity. Additionally, pay-as-you-go with funded systems as well as private occupational pension funds play an increasingly important role. Governments have also tried to encourage personal long-term saving by creating a stable economic and political environment, by establishing a legal framework for financial institutions, and by offering tax incentives to savers (World Bank, 1994, 2001). However, voluntary long-term saving accounts tend to be small. In fact, it is not clear whether tax incentives have increased aggregate saving, and most of the tax benefits have gone to high-income households.

In order to reduce the burden on future generations, the Portuguese Government introduced partial public capitalisation in 1989 with the creation of the Social Security Trust Fund (FEFSS). Funds not immediately used to pay out benefits are transferred into an investment fund. The return on the investments is used to build up financial reserves to help absorb the expected rising costs as more and more members of the active population go into retirement and long-term unemployment remains high.

Using simulation techniques, Silva et al. (2004) concluded that the fund's assets will reach a peak of 12.325 thousand million euros in 2012, and that the fund will be totally exhausted by 2026. Their analysis highlighted the need for corrective action when actuarial and financial criteria are not met.

In 1989, personal retirement savings schemes (PPR) were also introduced financed by retirement savings funds (FPR), followed in 1995 by savings plans in share-holding schemes (PPA). These are defined as personal savings plans within a savings fund based on shares (FPA). The initial success of these various forms of saving plans was partially due to the tax incentives provided by the government. The fundamental objectives behind their creation were to stimulate long-term household saving, and also the capital market by offering alternative forms of financing to enterprises. Additionally, the aim was to reinforce the funds' third-pillar role, by increasing the proportion of PPR and PPA funds (Garcia, 2004). However, lack of proper financial education and consumer regulation are often a problem (Garcia, 2006).

The present study aims to shed light on the factors determining participation in personal retirement savings plans, by using a specifically-designed survey, with detailed information on socio-economic characteristics and other variables, such as attitudes and expectations, which are particularly useful in this respect. Ours is an original contribution, since no similar analysis of retirement saving behaviour in Portugal has been carried out to date.

3. Literature Review

The literature on the interactions between private pensions, public pensions, and retirement income policies is growing rapidly. It is becoming increasingly clear that models based on long horizons, full information, and the life cycle hypothesis are not sufficient to understand these issues, and that factors such as rates of return and portfolio choices of individuals are also crucial (World Bank, 2005).

Standard saving theories, namely the permanent income hypothesis (PIH) and the life-cycle hypothesis (LCH), pay little attention to psychological factors, their focus being on the ability rather than the willingness to save (Browning and Lusardi, 1996). However, the importance of the former is recognised in more recent studies on saving behaviour (see, e.g., Wärneryd, 1989, 1996). Behavioural research on saving makes use of the concept of self-control (Thaler and Shefrin, 1981), the idea being that saving presupposes an effort or an act of willpower. Shefrin and Thaler (1988, 1992) characterised their model as an extension of the LCH one, and called it the Behavioral Life-Cycle Hypothesis (BLCH). It was found to predict accurately saving behaviour - for instance, the fact that people make additional pension provisions even in the presence of the public pension plans, which had already been stressed by Cagan (1965) and Katona (1975). Their model also predicts that consumption after retirement will be lower than before if pension income is relatively low, and that higher permanent income will lead to higher saving. Psychological research is useful in two main respects to understand saving behaviour (Wärneryd, 1999). First, it provides methods and techniques for collecting subjective and objective data that are otherwise difficult to obtain. Second, it provides psychological concepts and theories for describing, explaining, and predicting saving.

Saving behaviour is often investigated by conducting surveys. Lindqvist (1981) used cross-sectional interview data to analyse four different measures of saving, namely bank savings, repayments of debts, total savings and a liquidity estimate. The explanatory variables used in the regression analysis included socio-economic characteristics as well as expectations and attitudes variables. Lunt and

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Livingstone (1991) also consider psychological determinants in their study of British adults. Gunnarsson and Wahlund (1997) examine household financial strategies in Sweden, based on an exploratory study using k-means cluster analysis. Furnham (1985, 1999) analysed the effect of a variety of socio-economic variables, habits and attitudes on saving. Harris et al. (2002) investigated the determinants of saving in Australian families using telephone interviews, finding that retirement was one of the most frequently cited reasons. Euwals et al. (2004) provide evidence on household savings for old age from Dutch panel data, focusing on the attitudes of household members, following the work of Browning (1995, 2001) and Meier et al. (1999).

More recently, Canova et al. (2005) considers a hierarchical structure of saving motives, using network analysis and providing a comprehensive survey of the theoretical and empirical research on saving issues. Also, Bottazzi et al. (2006) estimate the effect of pension reforms on households' expectations of retirement outcomes and private wealth accumulation decisions in Italy. They find a substantial offset between private wealth and perceived pension wealth, confirming the substitution effect highlighted by Feldstein (1974) .

Lusardi (2003) examines savings in older families and the importance of planning for retirement using data from the Health and Retirement Study (HRS) (on this topic see also Ameriks et al., 2003). In addition, Lusardi and Mitchell (2006) analyse why people fail to plan for retirement and whether planning and information costs might affect retirement saving patterns.

To better understand these issues in the case of Portugal we conducted our investigation using a mixed logit model as detailed below.

4. The Model

Consider the proportion of the Portuguese population aged 30 or more. Our main objective is to determine the probability of subscribing to a personal retirement saving plan, given some given characteristics, denoted by the vector x_i. Define a binary random variable y_i, where $y_i = 1$ if the individual subscribes to a retirement plan and $y_i = 0$ otherwise, then the corresponding probability is $P(y_i = 1 \mid x_i)$.

Models to determine the probability of an event given a set of characteristics, x_i, can be based on a latent variable, y_i^*, that is not observed and satisfies the condition $y_i^* = \beta' x_i + \varepsilon_i$, where β is a vector of unknown parameters, and ε_i is an unobserved random variable allowing for individuals with the same characteristics x_i to achieve different outcomes. Adopting a general framework for binary dependent models, let us assume that $y_i = 1$ if $y_i^* > 0$ and $y_i = 0$ otherwise. Then $P(y_i = 1 \mid x_i) = P(\varepsilon_i > -\beta' x_i)$, where the probability depends on the statistical assumptions about ε_i. When ε_i is independent and identically distributed as extreme value type I, it is given by the widely used logit model:

$$P(y_i = 1 \mid x_i) = P(\beta, x_i) = \frac{e^{\beta' x_i}}{1 + e^{\beta' x_i}} \tag{1}$$

McFadden (1974), Ben-Akiva and Lerman (1985) and Train (1986) used the logit model to explain the probability of making a choice in terms of a set of variables reflecting the decision-maker's preferences.

In most applications, a better specification for the latent variable is $y_i^* = \beta' x_i + v_i + \varepsilon_i$ where v_i is a random term that accounts for unobserved heterogeneity among individuals who complete the questionnaire, with zero mean, and possibly heteroskedastic, with a distribution depending on the explanatory variables and underlying parameters. In our case, these are characteristics influencing the probability that an individual will subscribe to a personal retirement plan (and which are not measured or observed), or measurement errors in the variables. Unobserved heterogeneity has been considered in many recent studies such as Chesher (1984), Chesher and Santos Silva (2002), Dubin and Zeng (1991), Gonul and Srinivasan (1993) and McFadden and Train (2000). Since it is quite common, neglecting it is likely to lead to inconsistent parameter estimates or fitted-choice probabilities. In the present paper, we estimate a random coefficients logit or mixed logit as in McFadden and Train (2000). Theirs is a computationally intensive method, which requires specific assumptions about the statistical distribution of v_i, but it has the advantage of consistently estimating the parameters and the choice probabilities, provided valid distributional assumptions are made.

4.1 Empirical Framework

Surveys have become increasingly important to supplement aggregate data on household savings (Wärneryd, 1999). Our survey of saving behaviour is based on a representative sample of households rather than individuals (for the debate on this issue see Dahlbäck, 1991; Gunnarsson and Wahlund, 1997; Wärneryd, 1999). It relies on random face-to-face interviews, conducted between January and March 2004 in the main Portuguese cities, to

achieve national coverage. A random sample of 1000 households was selected. The sampling frame universe was drawn from the Portuguese Population List (compiled from the 2001 Census), containing 3,135,255 working individuals in 2004, which was obtained from the INE (National Statistics Institute of Portugal). The response rate was 68.2%. The questionnaire was pre-tested among the teaching staff of the Instituto Superior de Economia e Gestão (Institute of Economics and Management, the Technical University of Lisbon). The criteria of eligibility were that respondents had to be at least 30 years old, working full-time and be Portuguese citizens.

The questions were devised on the basis of the theory of life-cycle savings and the papers of Lindqvist (1981), Furnham (1985), Shefrin and Thaler (1988, 1992), Lunt and Livingstone (1991), Gunnarsson and Wahlund (1997), Guariglia (2001), and DeVaney and Chiremba (2005). The following hypotheses were tested:

H1 – Individuals who subscribe to a retirement savings plan are characterised by the following socio-economic characteristics: male, aged in his mid-forties, belonging to a small family and earning a high income. This hypothesis is based on Browning and Lusardi (1996), Danziger et al. (1982), Hurd (1987, 1990), and Burbridge and Robb (1985).

H2 – There are several motives for saving such as long life expectancy, bequest motives, precautionary motives and so on. These motives will vary from country to country, according to culture and tradition, as noted by Katona (1965), Modigliani (1986, 1988), Kotlikoff (1989), Hurd (1990)), Campbell and Mankiw (1990), Ando et al. (1992) and Carrol (1997).

H3 – Individuals who subscribe to a retirement savings plan base their decision on financial incentives, such as tax benefits. This hypothesis has been formulated by the World Bank (1994, 2001).

H4 – Individuals who subscribe to a retirement savings plan expect to have a longer retirement period, since they have the perception that longevity is increasing.

H5 – Individuals who subscribe to a retirement savings plan are concerned about their retirement income and classify themselves as savers. This is tested by DeVaney and Chiremba (2005) and Lusardi (2003).

H6 – Individuals who subscribe to a retirement savings plan have a distinct saving behaviour, opting to allocate voluntarily part of their income to savings and not relaying totally on retirement income.

H7 – Individuals who subscribe to a retirement savings plan are those who have a perception that public pensions will not match their expected expenditures during retirement, meaning that the replacement rate is too low for adequate retirement consumption. The replacement rate is the percentage of the old wage relative to the benefit from social payments and is a measure of the adequacy of social payments.

In order to test these hypotheses, we used a mixed logit representation which assumes that the probability of subscribing to a retirement savings plan can be described by a cumulative logit-probability function of the exogenous variables X_i, P(subscribe/type). The choice of exogenous variables was based on previous studies, but the final criterion was their statistical significance.

Therefore, we estimate probability for event *i* as:

$$P(Subscribe_i \mid v_i) = \int_{-\infty}^{+\infty} P(\beta, v_i) N(\beta \mid \mu, \sigma) \, d\beta \qquad (2)$$

where $N(\bullet)$ is the normal distribution, and:

$$v_i = \beta_0 + \beta_1 Family + \beta_2 Age + \beta_3 Gender + \beta_4 Income + \beta_5 LifeExpec \tan cy + \beta_6 Bequest +$$
$$\beta_7 \Pr ecaution + \beta_8 Investment + \beta_9 Health + \beta_{10} Earnings + \beta_{11} Tax + \beta_{12} \Re placement +$$
$$\beta_{13} Short + \beta_{14} Saver + \beta_{15} Money + \beta_{16} Bank + \beta_{17} DonotSave + \beta_{18} PerceptionLess + \varepsilon_i$$

$$(3)$$

We measure v_i as the probability that the respondent declares that he/she subscribes to a retirement savings plan (Yes = 1, No = 0) and X_i stands for observed characteristics. Firstly, we considered socio-economic individual characteristics: age, gender, household dimension and income. Secondly, we included (i) saving motives: life expectancy, bequest, precaution, investment, health and earnings; and motives for subscribing to a retirement saving scheme (PPR): life expectancy, tax benefits and replacement rate; (ii) longevity perception: low, average and high; (iii) relation between longevity and the retirement period perception: low, average and high; (iv) attitudes towards savings: important to save for retirement, not important to save for retirement, and I consider myself a saver; (v) saving behaviour: I save for retirement, I get advice from the bank to save for retirement, I do not save, and I do not save for retirement purposes; and (vi) replacement rate perception: about 100%, much lower than 100%.

There is a potential endogeneity issue inherent in the modelling of questionnaire data, because saving and income are potentially endogenous and measured with error. These two variables are simultaneously determined and must be modelled as such. This means two questions need to be estimated: one for the observed choice on savings, and the other for the income earned that affects the savings decision. Ideally, this problem

should be addressed with a simultaneous system of logit models; however, income is not dichotomic, and moreover the covariance relationship between the two equations is upper-triangular in nature and can be estimated efficiently with two equations, solving the endogeneity problem (see Greene, 2003). Therefore, two separate equations are estimated here, following Heckman (1978) and Hausman (1978). The first one is a Mincerian earnings equation (Mincer, 1974) that explains the earnings of the individuals as a function of exogenous instruments. The second is a mixed logit model where a function of the residuals from the Mincerian equation is included as an extra explanatory variable. This procedure has been adopted by Petrin and Train (2003).

4.2 Data Description

As mentioned before, the data were drawn from a questionnaire to analyse saving behaviour in Portugal. The analysis aims at detecting the main determinants of participation in a personal pension plan, specifically whether respondents' decisions are determined by precautionary considerations caused by a perceived higher longevity (see also Björkman et al., 2001). In our sample the proportion subscribing to PPRs (28%) is approximately the same as in the population submitting a tax return. The under-representation of males (48%) is another characteristic, and the average age is 44 years. Variable definitions and descriptive statistics are presented in Table I below.

Table I – Variable Definitions and Descriptive Statistics

Variable	Description	Minimum	Maximum	Mean	Standard deviation
Endogenous variable					
Personal Saving Account (PPR)	A dichotomic variable which is one if the respondent subscribes to a saving account and zero otherwise	0	1	0.281	0.450
Income	Current monthly income, scale in euros (1=[0, 750[; 2=[750, 1500[; 3=[1500, 2500[; 4=[2500, +∞[)	1	4	1.745	0.838
Hypothesis 1 - Socio-economic variables					
Family	The number of members of the respondent's family household	1	5	2.860	1.159
Age	The age of the respondent	30	77	43.95	9.09
Gender	Female=1, male=0	0	1	0.483	0.50
Hypothesis 2 - Saving motives					
Life Expectancy	A reason for saving: Life expectancy	0	1	0.217	0.412
Bequest	A reason for saving: Bequest motive	0	1	0.102	0.303
Precaution	A reason for saving: Precaution motive	0	1	0.687	0.962
Investment	A reason for saving: Investment	0	1	0.291	0.454
Health	A reason for saving: Health	0	1	0.351	0.477
Earnings	A reason for saving: Earnings	0	1	0.024	0.156
Hypothesis 3 - Motives for subscribing to a retirement savings plan (PPR)					
Tax benefits	A reason for subscribing to a PPR: Tax benefits	0	1	0.832	0.215
Replacement rate	A reason for subscribing to a PPR: Replacement rate	0	1	0.735	0.127
Hypothesis 4 - Relation between longevity and retirement period perception					
Short retirement period	In general retired people enjoy a short retirement period (1 = I disagree; 5 = I agree completely)	1	5	3.446	1.170
Hypothesis 5 - Attitudes towards saving					
Saver	I consider myself a saver (1 = I disagree; 5 = I agree completely)	1	5	3.762	1.087
Hypothesis 6 - Saving behaviour					
Money for retirement	I have money set aside in anticipation of my retirement (1 = I disagree; 5 = I agree completely)	1	5	2.460	1.352
Bank advice	I consult my bank in order to learn of better ways of saving for my retirement (1 = I disagree; 5 = I agree completely)	1	5	2.284	1.267

Do not save	I don't save for retirement purposes (1 = I disagree; 5 = I agree completely)	1	5	2.866	1.265
Hypothesis 7 - Replacement rate perception					
Less than 100%	People's income is on average much higher than their retirement pensions (1 = I disagree; 5 = I agree completely)	1	5	3.128	1.002
Human Capital Model					
Education	Level of education, in years of education	2	20	16.15	2.82
Experience	Individual's number of years working	1	32	15.205	14.053
Squared experience	Individual's squared years worked	1	225	27.992	16.426

5. Empirical Results

To take into account endogeneity in the earnings equations, we estimate the models with instrumental variables. Our instrumental variables are all the variables used in the model, together with three additional instruments for schooling and experience. Since the quality of the proxy variables is important (Maddala, 1992), we considered previous studies on earnings in relation to education for guidance as to the instrumental variables to use, as well as data availability. We chose the following ones: father's education (measured as number of years), assumed to have had an exogenous influence on the respondent's schooling (Butcher and Case, 1994); whether or not the father had a saving account, indicating a tradition in the family (Granoveter, 1973); the number of children of the respondent, assumed to have an exogenous influence on the respondent's age, since older individuals are more likely to have children (Brunello and Miniaci, 1999).

We carried out the tests proposed by Bound et al (1995) to shed light on the quality and validity of our instrumental variables. Instrumental quality is ensured if there is a strong correlation between the instrumental variables and schooling (it is well documented that an IV procedure using weak instrumental variables may yield more inconsistent point estimates than those produced by OLS). First, the F-test of joint significance for the respective instrument set is equal to 0.53. Second, instrumental variables are valid provided they affect earnings through schooling only. We tested whether our instrumental variables had any direct influence on earnings through schooling only with the Sargan test, a test of over-identification restrictions on the instrumental variables, with an asymptotic X^2 distribution and degrees of freedom equal to the number of over-identifying restrictions. This test statistic turns out to be equal to 4.31 (p-value=0.53), and hence we cannot reject the validity of the over-identifying restrictions.

To estimate the mixed logit model, we used a GAUSS simulator for mixed logit model downloaded from Kenneth Train's home page (http:/elsa.berkeley.edu/~train/Ps.html). Other results were obtained with TSP. We report results for both a standard logit and a mixed logit model for comparison purposes (see McFadden 1981, Louviere, Hensher and Swait 1991, Hensher and Greene 2003, and Hensher, Rose and Greene 2005).

Table II – **Parameter Estimates and t-statistics**

Variables	Earnings Equation (dependent variable: Earnings)		Mixed Logit (Dependent variable: To subscribe to a retirement saving plan Yes=1, and No=0)	
	Coefficients	t-stat	Coefficients	t-stat
Constant	-1.231	-3.525*	-2.538	-6.144*
Family	-0.075	-2.124	-0.066	-3.584*
Life Expectancy	0.731	1.527*	0.650	5.798*
Precaution motive	0.218	1.124	0.166	5.377*
Investment motive	0.116	0.536	0.099	3.934*
Health motive	-0.045	-0.253	-0.063	-3.610*
Earnings motive	0.218	0.388	0.303	4.014*
Tax benefits	0.125	1.853	0.235	5.452*
Replacement rate	0.215	1.567	1.128	4.384*
Short	-0.133	-1.542	-0.107	-3.556*
Saver	0.259	1.673	0.251	5.407*
Money	0.347	1.788	0.322	7.297*
Bank	0.205	1.393	0.196	4.852*
Do not Save	-0.091	-1.034	-0.074	-3.757*
Perception Less than 100%	0.012	1.375	0.012	4.893*
Education	0.251	3.128*	0.123	3.213
Experience	0.389	3.837*	0.134	4.132
Experience squared	-0.031	-2.126*	-0.012	-1.0127
μ_i	—	—	2.321	12.321
			Random Coefficients	
Age	0.214	1.325	0.180	3.748*
Gender	0.532	2.321	0.011	4.954*
Bequest motives	0.218	1.321	0.426	7.073*
Observations	682	—	682	—
LogLikelihood ratio test	-327.865	—	-329.729	—
Chi-square with 29 degrees of freedom (ChiSqd > value)	—	—	426.570 0.0005	—
Adjusted R Square	0.51	—	—	—

Breusch-Pagan het test	1.321	—	—	—

Regarding the earnings equation, estimated with IV variables, we find that, as expected, earnings are a function of various personal characteristics affecting human capital. Specifically, there is a statistically significant positive effect of education, experience and squared experience on earnings. The other variables affecting savings are found to be statistical insignificant in the earnings equation.

When estimating a mixed logit model, we find that the probability of subscribing to a PPR significantly increases with life expectancy, bequest motive, precautionary motive, investment motive, earnings motive, tax benefits, replacement rate, money availability, bank consultation, perception less than 100%, age, gender, and income. By contrast, this probability decreases with family dimension, health motive, short retirement period, saver, and do not save variables.

6. Conclusions

In this paper we have used survey data to estimate a logit model allowing for heterogeneity between individuals with the aim of shedding light on the determinants or retirement saving behaviour in Portugal. In order to take into account endogeneity, an earnings equation was also estimated, and it was found that the determinants of savings do not affect earnings. Both the dataset and the methodology used represent original contributions to this area of the literature.

Our results indicate that the probability of subscribing to a retirement savings plan is significantly related to various socio-economic characteristics, as well as attitudes

towards saving and perceptions of the replacement rate – in other words, heterogeneity matters. Therefore, the design of defined-contribution pension plans and asset-allocation decisions should take into account the presence of heterogeneity. Clearly, retirement saving plans involve a greater degree of risk relative to traditional defined-benefit schemes in terms of retirement income The shift from state- and employer-sponsored defined-benefit plans to individual defined-contribution plans represent a fundamental change in the way retirement provisions are made. In this context, it is crucial to understand saving determinants in order to identify policies enabling individuals to manage pension risk effectively. Given the presence of heterogeneity, any such policies should target clusters rather than the median individual.

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